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ABSTRACT

This paper characterizes appropriate content for drill activity, gives various cognitive levels of drill exercises, and provides ways in which to measure and report students' progress on drill activities. Drill is a method of teaching that utilizes repetition to assist students in acquiring new skills and refining existing skills. The success of using drill is based on conditions relative to the students' learning abilities and the content to be learned. Content is appropriate for drill exercises if specific demonstrable performances are expected, demonstrable performances are prerequisite for further learning, and the content may be measured in terms of a correct or incorrect answer or behavior. The four types of drill exercises include model exercises which require students to copy what has been presented to them, recognition exercises which require students to distinguish and perform correct as opposed to incorrect skills, construction exercises which require students to perform specific skills, and transfer exercises in which students apply their skills to new situations. Sample exercises for drill model recognition, proficiency assessment procedures, and data collection devices are included. (Author/DE)

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DRILL RE-EXAMINED: A TAXONOMY FOR DRILL EXERCISES LAB BOOK

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DRILL is a method of developing mastery through repetitive learning of fixed responses or pattern of responses to specific situations and conditions.

--The Authors

DRILL may be defined as a method of teaching that utilizes repetition (meaningful practice exercises) to assist students in acquiring new skills, enriching already acquired skills, and/or refining skills already learned but in need of re-development.

--The Authors

DRILL

Directions: Each person should read the following statements below and check the appropriate space as to whether you feel the statement is correct or incorrect.

Statement	Correct	Incorrect
1. Drill is an outmoded instructional technique.	____	____
2. Generally, I disapprove of the use of drill as a teaching technique.	____	____
3. The use of drill disregards individual learning differences.	____	____
4. Drill is a means for encouraging student motivation for learning.	____	____
5. Drill can be effectively used with the learning of abstractions and values.	____	____
6. In drill students look at a word for the 75th time for the same reason as they did the first time.	____	____
7. Word search puzzles are examples of drill exercises.	____	____
8. Drill exercises can promote higher level thinking.	____	____
9. All content of a school's curriculum can use drill exercises.	____	____
10. Such factors as age and readiness influence the sources of using drill.	____	____

Directions: Discuss your responses with the other members in your group. In the space provided, signify the group's consensus to each of the above statements.

Statement	Disagree	Divided	Agree
No. 1	____	____	____

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No. 2	____	____	____
No. 3	____	____	____
No. 4	____	____	____
No. 5	____	____	____
No. 6	____	____	____
No. 7	____	____	____
No. 8	____	____	____
No. 9	____	____	____
No. 10	____	____	____

INTRODUCTION

The instructional objectives of this drill lab exercise book are for the participants:

1. To be able to identify present attitudes toward the importance of drill exercises as an instructional technique
2. To be able to identify the correct definition of drill as it is used in this lab exercise book
3. To be able to classify the characteristics of the four basic categories of drill exercises
4. To be able to discriminate among the four basic categories
5. Given a lesson, to be able to write a drill exercise at each category
6. To be able to identify criteria used in designing proficiency measurement techniques used in evaluating student progress
7. To be able to select the correct explanation of proficiency assessment procedures

DEFINITION

Drill is a method of developing mastery through repetitive learning of fixed responses or pattern of responses to specific situations and conditions. That is, the word "drill" may be defined as a method of teaching that utilizes repetition (meaningful practice exercises) to assist students in acquiring new skills, enriching already acquired skills and/or refining and maintaining skills learned but in need of re-development. The primary purpose for drill exercises, therefore, is to extend, reinforce and refine a student's capabilities to do specific mental and/or physical performances. By providing achievement feedback and by regulating the amount and number of practice sessions, the use of drill should foster higher levels of correct performance to the point of mature response. Finally, drill is not a means of or a substitute for encouraging motivation, although the desire on the part of students to perform correctly and with precision is a major influence on achievement.

Directions: There are four categories of drill exercises below. Each category is illustrated by three examples of drill exercises. Study the four categories and identify by checking those characteristics (found on the following page) associated with each category.

Category I

1. Mr. Beasley is having his class learn different phonetic sounds. For example he has his students pronounce the ch as in the word church as demonstrated by him.

2. The teacher has given students a sample time line depicting different events that occurred from 1929-40. The teacher has instructed the students to copy the time line three times.

3. In learning the backstroke in swimming, the teacher guides the student's arms in the movement with the student attempting the stroke several times with the teacher assessing the student's progress.

Category II

1. A teacher made a word search puzzle over previously learned words for the unit.

2. In a color collage provided by the teacher, students are to identify the previously learned primary colors.

3. In this foreign language exercise, mark the correct plural form of each of the following words by putting an X in the proper square. At the beginning of the exercise you are shown two instances (ett hus, tva hus, and en person, tva personer) and how to treat them.

Category III

1. Please translate the following sentences into French.

2. Identify and list three of the previously learned characteristics of our checks and balances form of government.

3. Given a blank typewriter keyboard, fill in the appropriate letters, numbers, and symbols.

Category IV

1. Mrs. Swick instructs the class to do the following exercise: "You have just rented and opened a small clothing store in Murdale Shopping Center. Determine the number and types of ledger accounts needed for your store."

2. The following assignment was given to one class: Given a rectangular living room to design (placement of six pieces of furniture), place the furniture in three different floor arrangements utilizing the principle of floor space."

3. Mrs. Miller gave this assignment: "Using the weather maps provided by the United States Weather Service, learn the most appropriate states for growing corn, oranges, and grapes."

Characteristics	Categories I	II	III	IV	Does Not Apply
1. Direct imitation	___	___	___	___	___
2. Valuing	___	___	___	___	___
3. Recognition from opti s	___	___	___	___	___
4. Adaptation to a new situation	___	___	___	___	___
5. Reproduction from example	___	___	___	___	___
6. Reconstruction of answers	___	___	___	___	___
7. Answer construction in a new situation	___	___	___	___	___
8. Answer from memory	___	___	___	___	___
9. Utilization	___	___	___	___	___
10. Copy	___	___	___	___	___
11. Interpretation	___	___	___	___	___
12. Application	___	___	___	___	___
13. Repetition	___	___	___	___	___
14. Recall (few/no clues)	___	___	___	___	___
15. Transfer	___	___	___	___	___
16. Differentiation from options	___	___	___	___	___

Directions: As a group discuss your individual responses to the above task. Indicate the degree to which your group has reached consensus.

	Fully Agree	Partly Agree	Disagree
1.	____	____	____
2.	____	____	____
3.	____	____	____
4.	____	____	____
5.	____	____	____
6.	____	____	____
7.	____	____	____
8.	____	____	____
9.	____	____	____
10.	____	____	____
11.	____	____	____
12.	____	____	____
13.	____	____	____
14.	____	____	____
15.	____	____	____
16.	____	____	____

Directions: Please read and study the following materials:

LEVELS OF DRILL EXERCISES

Four different levels (model, recognition, construction, and transfer) of drill exercises may be used for learning. Each level requires a greater degree of sophistication in skill response. With each succeeding level, practice is provided that allows for expanded discretionary skill expression in terms of the type and quality of responses needed by the student. Specifically, the four drill exercise levels are described in the following.

Type I: Model Exercises

1. Modeling drill exercises require students to repeat accurately and with perfection only what has been presented to them.
2. Copying, pronouncing, reproducing, and spelling are all examples of this type of drill activity.
3. Repeat exercises are a rote approach to learning where emphasis is placed on mastery of the task.
4. Model exercises are used as a means for emphasizing specific components with minimum attention given to the overall use and meaning of the material.

Type II: Recognition Exercises

1. Recognition exercises require a student to demonstrate competency by distinguishing and differentiating between the desired material and that which is deemed unimportant or false.
2. This level of drill ability requires the student to identify, note, select, and match those characteristics associated with the correct answer.
3. The selection of the correct and/or incorrect words in a foreign language class that indicates a particular gender, matching the correct answer with a mathematics problem, and the identification of those correct events as opposed to incorrect events pertinent to an historical event are all examples of recognition exercises.
4. The ability to identify distinguishing characteristics of the correct answer and to select these characteristics from similar but different answers is the primary function of this type of drill exercise.

Type III: Construction Exercises

1. Construction exercises require reconstruction of skills from memory rather than by means of comparison and selection.

2. Such exercises demand that students practice the correct answers with few, if any, clues as to the response.

3. In effect, students have to organize, memorize, and respond with that performance or information requested with little assistance.

4. Examples of this type of drill exercise would be to ask students to list possible solutions for a specific situation, to list the tense for specified verbs, or to perform certain gymnastic feats.

5. Typically, construction exercises require students to construct a total skill behavior in the sense that few clues are given and yet a sequential set of responses is generally expected.

Type IV: Transfer Exercises

1. Transfer exercises are ones designed to have students apply and adapt their learned content and skills to a given situation. Such exercises are generally situational, task oriented, and problematic in nature.

2. In transfer exercises students demonstrate their competence by using and adapting their knowledge and skills in situations which may include arrangements, measurement, assessment, analysis, construction, and decoration.

3. This type of exercise may demand either specific replication or adaptation of skills.

4. Instances where transfer exercises may be appropriately used include structure framing of a house, interpreting and organizing information, tuning a car engine, drafting a plan for installing a heating system, evaluating art work, assessing a city's public transportation needs, and analyzing a school's curriculum. In such instances, the accomplishment of the task, the use of knowledge and skills, the levels of performance, and the degree of adaptation can be determined and measured by the teacher.

SUMMARY OF THE DRILL LEVELS

	STUDENT BEHAVIOR	TYPE OF KNOWLEDGE ACQUIRED	STUDENT EXPOSURE REQUIRED
MODELING	Repeat Model Copy Reproduce Imitate	Deals with units of knowledge	No previous exposure necessary
RECOGNITION	Discriminate Discern Distinguish Differentiate	Deals with a cluster of knowledge units	Some degree of exposure required
CONSTRUCTION	Recall Reconstruction Limited Assistance	Deals with a cluster of knowledge units organized in a coherent fashion	Extensive exposure required
TRANSFER	Apply Utilize Transfer	Deals with principles underlying a cluster of knowledge units	The three previous steps must have been mastered. It is assumed that students are familiar with content, that they have mastered it, and that they have identified its unifying principles.

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Directions: After studying these four types of value statements (and without peeking) each person should identify the following as to: (a) Modeling exercises, (b) Recognition exercises, (c) Construction exercises, (d) Transfer exercises.

1. ____ Provide each student with a map of the community. The students are asked to recopy the map making the appropriate identification of community services as they were identified on the original map.

2. ____ Crossword puzzles

3. ____ Fill in the adjective and a noun in the following sentences, choosing from the words below. Use all the words and place them where they seem to be in keeping with the context.

4. ____ List the seven characteristics of the Monroe Doctrine.

5. ____ Change the verb in the following into the past, present perfect, and future tenses.

6. ____ An electrician collected $437 for an electrical renovation job. For the various materials he used on the job, he pays $84, $37, $13, and $77. How much does he receive for his labor?

7. ____ When you say these words, give the ch the same sound you give to k in kite.

8. ____ Word search puzzles

9. ____ Design a house floor plan for a family of five, consisting of 1900 square ft.

10. ____ A carton brush has the following dimensions: 1.73 inches wide, 3/4 inches high, and 1-13/16 inches long. If 1/8 is taken off the width and 1/16 inch is taken off the height, what are the new dimensions for the width and height.

Directions: Discuss your answers with the other members in your group. In the space provided, signify the group's consensus to each of the above statements.

1. ____ 3. ____ 5. ____ 7. ____ 9. ____

2. ____ 4. ____ 6. ____ 8. ____ 10. ____

Directions: When your group has reached a consensus on each statement, compare your individual and group responses with those found on the next page.

How did you do? Compare your responses with those below.

1.	A	3.	B	5.	C	7.	A	9.	D
2.	B	4.	C	6.	D	8.	B	10.	D

FURTHER EXERCISE EXAMPLES

Modeling Exercises

1. Provide each child with a map of the community. Have the children recopy the map making the appropriate identification of community services as they were identified on the original map.

2. Give the students a sample time line depicting different historical periods of time. Have the students then model the activity by copying the time line.

Recognition Exercises

Crossword Puzzles: The procedure for constructing a crossword puzzle are:

1. Select a topic or subject (frequently this is a chapter in a textbook)

2. Obtain information about the topic and note those statements with one or two key words

3. Select the largest word you have for an answer--the largest in terms of letters used, especially the different letters--as your base word

4. Write the base word on a sheet of paper either vertically or horizontally

5. Try to fit the rest of the words to the base word or to a word already attached to the base word

6. Write a statement (as a clue) for the words that have been used, number the words and the statements

7. Draw a crossword puzzle providing the necessary spaces for the identified words

Composition and Grammar
Adjective - modifies and describes nouns
Adverb - end in ly; where, when, and how
Auxiliary verb - be, have, and do
Fable - story with animals as characters
To - infinitive
Tense - indicates time

AUXILIARY VERB

d d
j v
e tense
c r
to fable
i
v
e

A	U	X	I	L	I	A	R	Y	V	E	R	B
d						d						
j						v						
e					t	e	n	s	e			
c						r						
t	o			f	a	b	l	e				
i												
v												
e												

Check Charts: Mark the correct plural form of each of the following words by putting an X in the proper square. Only one marking is allowed for each word. At the beginning of the test, you are shown two instances (ett hus, tva hus, and en person, tva personer) and how to treat them. Proceed in the same way with the other words

	-or	-ar	-er	-n	-
hus					
person					
affar					
arbete					
betya					
bord					
brev					
buss					
dam					
darr					

Construction Exercises

A. Translate the following sentences into French.
   1. On our way to Copenhagen we visited our old friends.
   2. Every morning I drink two big cups of hot coofee.
   3. May I see the menu?-Here you are, sir. I would recommend this dish. It is very good.
   4. What sort of weather is it?-It is rather cold--and rainy, too.

B. List the seven characteristics of the Monroe Doctrine that were presented in the textbook.

Transfer Exercises

1. Meal planning in a Home Management class. As your final assignment, plan three meals, disregarding cost, for a pregnant woman and a teenage boy. (Knowledge about nutrition content of foods and specific dietary requirements of certain persons are required before this exercise can be performed.)
2. Design a floor plan for a one-story house with approximately 2000 square feet and include three bedrooms, two bathrooms, one kitchen with eating area, one living room with fireplace, and a utility room. Include four closets. Optional areas which may be included are one family, carport or garage, extra closets, and storage areas.

Directions: Using your content area as a vehicle for this next step, design one drill exercise that you could use in your classroom. After you have completed the exercises, compare your exercises with a member of your group.

Exercise #1

Course Title _____

Grade Level _____

Type of Drill Exercise _____ Unit _____

ASSESSMENT PROCEDURES

Directions: Read the following situation and answer the accompanying questions by circling the option that you feel best describes an appropriate response.

Mrs. Meyers' typing class has been working on typing speed and accuracy. The following scores were achieved by Ralph over the past five days.

Day 1	22 WPM (words per minute)	20 CWPM (correct words per minute)
Day 2	18 WPM	17 CWPM
Day 3	25 WPM	19 CWPM
Day 4	21 WPM	21 CWPM
Day 5	23 WPM	22 CWPM

The class average over the past five days was 18 WPM with 12 CWPM.

1. Assign approximate grades for Ralph for each of the five days according to speed and accuracy.

	Speed	Accuracy	Comments
Day 1	_____	_____	_____
Day 2	_____	_____	_____
Day 3	_____	_____	_____
Day 4	_____	_____	_____
Day 5	_____	_____	_____

2. Identify other ways in which Ralph's performance in speed and accuracy could be described.

_____
_____
_____
_____

3. Rank order from one to four (with one being highest) the following four methods of determining achievement for Ralph.

____ Comparison with class
____ Comparison with self
____ Comparison with student teacher's standards
____ Comparison with national typing standards

Directions: As a group list those factors which you considered to answer the above tasks.

Task 1. _____
_____
_____
_____

Task 2. _____
_____
_____
_____

Task 3. _____
_____
_____
_____

PROFICIENCY ASSESSMENT PROCEDURES

A persistent concern of educators, especially with reference to the emergence of accountability, who utilize drill exercises as a mode of teaching relates to the assessment and evaluation of skills delineated for students to acquire. There are some basic procedures educators can utilize in (1) designing proficiency level criteria, (2) selecting appropriate data collection devices, (3) utilizing evaluative data in determining student progress toward meeting desired skill proficiency levels, and (4) relating evaluative data to drill exercises program improvement. Each of these components are explained in the following sections of the paper.

Designing Proficiency Level Criteria. A basic component of any evaluation program is the development of criteria upon which the student will be assessed in terms of desired skill performances. Included in the "criteria" aspect of evaluation would be the following: (1) clarification of the desired level of proficiency, (2) formulation of what skill performance will meet minimum standards of acceptance, (3) determination of time allowed for the accomplishment of the desired skill performance, and (4) organization of how evaluative results will be utilized in terms of student progress.

Selection of Data Collection Devices. In organizing a proficiency measurement system it is necessary to select appropriate data collection instruments that are conducive to assisting the teacher in assessing student achievement on a desired skill. In selecting data collection procedures, utilize the basic guidelines as follows: (1) the device should be related to the drill exercise used in teaching the skill, (2) the device should contain a way of recording data in a useful form, (3) the device should be easy to use in terms of time and space factors, and (4) the device should be useful in terms of reporting data to teachers, students, and related educators.

Utilizing Findings in Determining Student Progress. Two basic areas of concern that must be dealt with when evaluating student progress are (1) interpretation of data results, and (2) the meaning of the data for student and teacher in the instructional process. When interpreting data in relation to student accomplishment on a drill exercise, the teacher should attempt to examine the total implication of the data. For example, in a typing class the number of words typed correctly may tell you much more than simply counting the number of words typed per minute. In the same respect the teacher and student should examine the data for meanings that can assist them in improving their performance of the desired skill.

Utilizing Findings To Improve Drill Exercise Program. An important part of assessing the effects of drill exercise upon the student is the implications of the results of performance for the drill exercise program. For example, if a student consistently fails to achieve a desired skill through the use, say of a construction drill exercise, it may be that the specific drill exercise is ineffective as a mode of teaching this child the skill. Or, it may mean that the child is not ready to learn the skill desired. Whatever the situation, it is important to utilize evaluative results not only as a tool of assessing student progress, but also as a feedback mode on your drill exercise program.

Summary. In selecting and utilizing proficiency assessment procedures it is necessary to design criteria upon which performance will be evaluated, select appropriate data collection devices for the kinds of behaviors and/or performances you will be evaluating, utilize evaluative results to promote student progress, and organize the assessment procedure so that you can also have an on-going assessment of your drill exercise program.

SAMPLE DATA COLLECTION DEVICES AND PROCEDURES

There are a variety of data collection devices and procedures which can be used to assess student progress in terms of proficiency attainment. Some of these devices and approaches are: (1) directed and informal observation, (2) scrapbooks, logs, diaries, (3) check lists, rating scales, inventories, (4) charts and graphs, and (5) work samples and activity records.

Directed and Informal Observations. Directed observations, where the teacher or observer is observing specific behaviors in terms of skill attainment, can be helpful in formulating a decision on whether the student has/has not achieved the skill at the desired level of proficiency. In driver training courses the instructor usually has specific performances he/she is looking for demonstrable behaviors.

Informal observations by the teacher for incidental behaviors related to the total skill desired can also be useful in making a total evaluation of student progress. Information acquired through formal and informal observations can also be helpful to the teacher in designing new learning exercises for the students.

Scrapbooks, Diaries, Logs. Any form of student-produced materials such as diaries, scrapbooks, and logs can provide the teacher with feedback on the long-term performance of the student in terms of the desired skill. For example, in attempting to assess transfer behaviors of students on transfer exercises, the teacher can have the children keep a log of their achievements on each exercise. These forms of proficiency level assessment are most functional for evaluating long-term performances of the students.

Check Lists, Rating Scales Inventories. An effective means of recording pupil progress in an efficient way is through the use of rating scales, check lists, and behavior inventories. For example, an efficient way of keeping track of student

performance on phonic skills is to develop a check list of the skills which can then be checked off as the student learns them. Another means is to record the pre- and post-test for each skill and to record re-learning, if needed. A sample of an achievement is provided on the following page.

Charts and Graphs. A visually useful device for assessing student progress is to graph or chart student performance on the desired skills as it is performed. Mathematics educators have long used graphs to show students how they are progressing, say on number acquisitions skills. Swimming coaches also use this device by keeping a chart of the performance of the swimmer throughout different events during the year. Charts and graphs provide a way of looking at the total, long-term performance of the student.

Work Samples and Activity Records. Some drill exercises are best evaluated through assessing the work samples produced by the student. Construction exercises, such as in drafting, crafts production, or design patterns, lend themselves to work sample evaluation. Although the teacher may evaluate different behaviors of the students as they are producing the work, the final product often provides a mode of assessing strengths, weaknesses, and needed future work directions for both teacher and student.

NAME _____

SAMPLE ACHIEVEMENT PROFILE FOR MATHEMATICS

TOPICS			FRACTIONS		PERCENT		DECIMALS		MEASUREMENT		SIGN #		ALGEBRA		GEOMETRY	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	DATE																
	SCORE																
REMEDIATION	DATE																
	SCORE																
	DATE																
	SCORE																
	DATE																
	SCORE																

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SELF TEST: PROFICIENCY ASSESSMENT PROCEDURES

Directions: Read each of the following statements and fill in the blank utilizing one of the suggested responses.

1. When the teacher of reading sets the level of achievement for the student, she is _____ (designing criteria, selecting assessment procedures).

2. A sheet developed by the teacher to keep track of the phonics skills acquired by the students is called _____ (log, rating scale, check sheet).

3. Mrs. Jumper, the drafting teacher, is going to evaluate the students on the product they made this past month. She is utilizing the _____ (diary, work sample) method of proficiency assessment.

4. Mrs. Williams, a teacher of reading, is meeting with each parent tomorrow and will show the parents the month-long progress of the students. Most likely she will use a _____ (reading inventory, readinggraph) to show the progress.

5. Mr. Miller has just completed his process of deciding upon the use of logs as a way of keeping track of the student progress on writing skills. He was _____ (selecting assessment devices, designing criteria for achievement).

6. Mr. Beasley is showing the curriculum director the results of his spelling achievement tests for the students. They are discussing the implications of the findings. They are in the process of _____ (selecting assessment procedures, interpreting data findings).

7. Mr. Jones, Curriculum Director of District 11, is developing a new drill exercise program based upon the findings of student achievement on mathematics skills this year. He is _____ (designing criteria for achievement, utilizing data to improve drill program).

8. Mrs. Miller, the physical education teacher, is taking notes on student progress in developing small muscle skills. She is utilizing the _____ (work sample, directed observation, informal observation) assessment method.

9. Mr. Swick has just told his Typing III class they will have three minutes to type one hundred twenty words. He has _____ (designed a criteria for achievement, selected a way of evaluating student progress).

10. The Superintendent of District 82 has announced to his teachers that they must report student performance in the area of reading to him quarterly. Probably the best method of reporting the progress of students would be _____ (logs, rating scales, graphs).

We need your help in the further development of this drill packet. Could you please respond to each of the following questions? Thank you.

1. After working through the exercises and the discussions that followed, did you feel that your interest and/or understanding of drill had been enhanced?

   a. Definitely b. Yes c. No d. Not sure

2. To what extent was the explanation of the various levels of drill clear and easy to understand?

   a. Very clear b. Satisfactory c. Somewhat vague d. Very difficult to understand

3. Circle level of drill that you did not understand.

   a. Modeling b. Recognition c. Construction d. Transfer

4. Do you believe that the four levels of drill constitute a taxonomy?

   a. Yes b. No c. Not sure

5. If your answer to the above questions was "no" or "not sure," could you briefly explain.

6. Was the section of drill levels practical and useful?

6. a. Yes b. No c. Not sure

7. To what extent was the section on proficiency measurement clear and easy to understand?

   a. Very clear b. Satisfactory c. Somewhat vague d. Very difficult to understand

8. Was the section on proficiency measurement practical and useful?

   a. Yes b. No c. Not sure

9. This was a good learning activity.

   a. Strongly agree b. Agree c. Not sure D. Disagree d. Strongly disagree

10. How could this activity be improved?

INTRODUCTION

Drill is used by most classroom teachers at some time as an instructional technique for teaching their students. Frequently, the use of drill is criticized for its supposed association with rote learning, lack of creativity, reliance on forced regimentation, passivism, and general disregard for learning differences. Such criticism and complaints of drill from both teachers and students are not solely the result of excessive use but also the result of inappropriate application of a teaching technique that has an important function in the process of instruction. The success of using drill, like any technique for instruction, is based upon a number of conditions relative to the student's learning abilities and the content to be learned.

Drill is a method of developing mastery through repetitive learning of fixed responses or pattern of responses to specific situations and conditions. That is, the word drill may be defined as a method of teaching that utilizes repetition (meaningful practice exercises) to assist students in acquiring new skills, enriching already acquired skills and/or refining and maintaining skills learned but in need of re-development. The primary purpose for drill exercises, therefore, is to extend, reinforce, and refine a student's capabilities to do specific mental and/or physical performances. For the most part, it is often difficult to ascertain a distinction between mental and physical performances since most performances require both mental perceptions as well as visible expressions of learned capabilities. By

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providing achivement feedback and by regulating the amount and number of practice sessions, the use of drill should cause higher levels of correct performance to the point of mature response. Further, although the desire on the part of students to perform correctly and with precision is a major influence on achievement, as it is with any method of instruction, drill is not a means of or a substitute for encouraging motivation.

Recognizing that drill exercises are primarily designed to facilitate mastery of specific mental and/or physical performances, it is the intent of this paper to (1) characterize appropriate content for drill activity, (2) describe various cognitive levels of drill exercises that may be used in a learning situation, (3) provide ways in which to measure, and (4) report students' progress on drill exercises. The overall purpose, therefore, is to establish a rationale and guidelines for the appropriate rather than misuse of drill exercises. The role and use of drill is a valid and necessary method on instruction, and its usefulness will be determined by how it is used and the purposes for which it is used in a learning situation.

APPROPRIATE CONTENT

One of the first considerations in the use of drill is the selection of appropriate course content for drill exercises. Each course, depending upon the content and the teacher's objectives, poses its own unique potential for drill usage. Although it is difficult to prescribe exactly what course content is appropriate for drill exercises, one way is to select that material in which the learning of specific demonstrable performances are expected. These performances, which may be listed and described in sequence or at random, may be characterized by processes, principles, rules, laws, theorems, designs, approaches, and/or methods. The ability to draw graphs, pronounce words, use rules of grammar, and apply mathematical computations, are just a few examples of the performances that would increase proficiency through drill exercises.

A second way to identify appropriate content for drill activities is to determine the extent to which the content is a prerequisite for further learning. If specific content needs to be mastered for more advanced learning to take place, drill activities may be used to strengthen students' readiness for additional work. Students in an algebra course, for example, need to have some fundamental concepts concerning mathematics well in mind. The same may be true for courses such as bookkeeping, typing, shorthand, carpentry, foreign languages, sewing, and chemistry.

A third way to determine if drill is an appropriate instructional technique is to note whether or not the content may be measured in terms of a correct or incorrect answer or behavior. As such, the use of peer group monitoring may be effectively employed in grading drill exercises. If levels of proficiency may be determined in a measurable form, the content lends itself to drill exercises. However, drill is a questionable instructional technique for content that concerns abstractions. Interpretations, values, and creativity, where "right" answers are difficult to provide, measure, and prove. In a sewing course, for example, there is a right and a wrong way to do certain types of sewing stitches.

Four, when content can be mastered through practice, it is appropriate for drill. Mastery, proficiency, and improvement brought about by drill usually involves studied effort, rather than innate learning capabilities of an exceptional nature. That is, a student's accuracy, precision, rate and amount of learned content, may be increased to a desired level of proficiency and that only normal physical and mental capabilities are required for mastery. While it is recognized that such factors as age, motivation, fatigue threshold, and readiness do influence and determine the success of using drill in a given setting, the end result of the continued use of drill is mastery. This fact is critical when it is recognized that most content and skill activity is amenable to drill techniques.

LEVELS OF DRILL EXERCISES

While drill exercises are characterized by repetition, feedback, and proficiency as common denominators, drill exercises may be purposely designed to require varying levels of student mental activity and response. Although drill has been perceived as an immediate imitating response of the teacher, other forms of drill exercises may be used to enhance recall and achievement by providing practice in contrived contexts that require mediated responses.

Four different levels (model, recognition, construction, and transfer) of drill exercises may be used for learning. Each level requires a greater degree of sophistication in skill response. With each succeeding level, practice is provided that allows for expanded discretionary skill expression in terms of the type and quality and responses needed by the student. Specifically, the four drill exercise levels are described in the following.

Model Exercises

Modeling drill exercises require students to repeat accurately and with perfection only what has been presented to them. Copying, pronouncing, reproducing,

and spelling are all examples of this type of drill activity.which is designed to develop and ensure accuracy of performance at a desirable level under close teacher supervision. A further purpose of repeat exercises is to allow the teacher to present a more direct form of example setting add response giving. By providing ideal examples free from contextual use, corrected feedback and repeated practices on an individual basis can be used to enhance acquisition. The offering of exact reproduction of what is to be learned followed by immediate attempted response and in some instances repeated responses, provides greater opportunity for replication by students. Basically, repeat exercises are a rote approach to learning where emphasis is placed on mastery of the task rather than the importance of the task to the total course content. Foreign languages, vocabulary lists, mathematical processes and operations, music lessons and band rehearsals, physical education exercises, and penmanship are instances where duplication and modeling procedures can be adequately used.

Frequently, repeat exercises are used as a means for emphasizing specific components with minimum attention given to the overall use and meaning of the material. The mastering of certain phonetic sounds to achieve the correct pronunciation in a word is an example of focusing on the learning of specific components. Usually students are unaware of the total importance of that required to be learned. Importance and meaning are generally realized when specific mastered components are learned and chained together. When learning multiplication tables, for example, initial emphasis is placed on number responses rather than on all of the possible uses of the mathematical manipulations involved.

Repeat exercises are widely used for a variety of content at all levels of education. When learning to print letters of the alphabet, elementary students are asked to trace over a letter in order to coordinate their motor action as well as to master the correct form for the letter. Or, in learning to develop

inflection skills for Russian, the teacher may use choral or class responses as a method for practicing the correct pronunciation.

Direct modeling of knowledge and behavior is also necessary in learning to play a note on a flute. The positioning of the fingers is one of the first steps to be mastered. Not only using the correct fingers, but also the manner in which the flute is held is extremely important. By watching the teacher demonstrate the finger positions and the manner in which the flute is held, students can practice from observation. Instruction can also be further directed and specified if needed by having the teacher place the student's fingers on each key so that the student will get the proper feel and finger positioning for holding the flute.

Therefore, modeling exercises are most generally used with introducing subject matter to students. By taking the knowledge or content, in a piece-by-piece fashion, learning becomes manageable. After the use of various demonstrations plus the subsequent mastery of the content, the increments of information can be integrated into a whole skill.

Recognition Exercises

While modeling exercises are appropriate for introducing subject matter, recognition activities are geared primarily for reinforcing what has previously been learned. These exercises require a student to demonstrate competency by distinguishing and differentiating between the desired material and that which is deemed unimportant or false. This level of drill ability requires the student to identify, note, select, and match those characteristics associated with the correct answer. The selection of the correct and/or incorrect words in a foreign language class that indicates a particular gender, matching the correct answer with a mathematics problem, and the identification of those correct events as

opposed to incorrect events pertinent to an historical event are all examples of recognition exercises. The ability to identify distinguishing characteristics of the correct answer and to select these characteristics from similar but different answers is the primary function of this type of drill exercise.

When writing recognition exercises where students must select the correct answer, the use of foil responses may be used by the teacher. When asking a student to circle the correctly spelled term from a series of similar terms, one approach would be to construct a foil by spelling the term backwards. A second approach to writing foils is to change a component of the correct answer so as to make this option appear correct to the nondiscriminating student. A key factor in a word could be changed to make the word an incorrect option for selection. A third means is to construct a nonsense response in which the ordering of the components of the correct answer are arranged in a nonsense order. When asked to select the word "vitamins" from a list of similar words, one of the options may be written as "ntvismia." A further approach is to provide a response in which a component or components are omitted from the correct response where students need to examine and respond on the basis of a supposed facsimile. A final approach for recognition foils is to reverse two or more of the response components. Such an approach is extremely useful when sequencing and ordering are important in mastery of performance. Certainly, other types of foils may also be developed and used effectively for recognition exercises. Each performance possesses its own unique characteristics in which foils may be derived from for this level of drill activity.

Using recognition exercises allows students to demonstrate their capabilities when noting similarities and differences among specific skill components. Unlike modeling, in such exercises students practice their capabilities by selecting appropriate responses when confronted with competing choices. Not only may

specific performances be practiced, but recognition exercises also provide for manipulations of the environment in which the student response is made. By offering this opportunity, teachers can also provide for experience in reinforcing relationships, sets, and associations of performance.

Construction Exercises

Construction exercises are generally open-ended exercises and demand that students practice the correct answers with few, if any, clues as to the response. In effect, students have to organize, memorize, and respond with that performance or information requested with little assistance. The sequence of the answer given, in some instances, may be very important while in other instances it may not be necessary. When asked to list, demonstrate and enumerate skill information, few directions are provided by the teacher. Examples of this type of drill exercise would be to ask students to list possible solutions for a specific situation, to list the tense for specified verbs, or to perform certain gymnastic feats.

Construction exercises may fulfill many functions of drill practice. For one, such exercises require students to construct a total skill behavior in the sense that few cues are given and yet a sequential set of responses is generally expected. It provides students with the chance to practice chaining specific responses and sequencing them into a logical framework based upon minimal cues from the teacher.

The construction exercise may also be used to reinforce the student's previously learned skills which are now being applied in a comprehensive performance. Therefore, construction exercises may be used effectively as a means for illustrating the importance of the skill components. For example, in developing the arm motion for the sidestroke, the student can better understand the need for practicing separate arm movements when asked to demonstrate the sidestroke.

Reading is an example of a skill area where construction exercises are especially useful. If the teacher wants students to read such previously learned words in sentence form as: Washington painted his boat blue before eating supper, students need to know the words used in the sentence, how they are ordered, and how to comprehend them in sentence form. In this situation, students are: (1) reinforcing words they have already learned; (2) gaining practice in chaining the words into a sentence; and (3) developing the skill of reading sentences. The same exercise could be used as a preassessment to demonstrate if students have learned these words or as a postassessment to determine achievement.

Coaches of athletic teams also frequently use construction exercises. The team that can correctly construct "plays" in a non-game situation is more likely to implement the plays in the game itself. The players must not only learn each separate move of the play, but how to chain them and harmonize them together for the implementation of the total play.

Just as the construction exercise is difficult for students, so it is for teachers to evaluate total performance. An example is the drama club that executed each part of a performance correctly, but the total performance never developed the way it should. Thus, teachers need to organize their evaluation program to meet the total skill desired from the students.

Transfer Exercises

Transfer exercises are used when a student has integrated a body of knowledge and can apply various principles. Transfer exercises are ones designed to have students apply and adapt their learned content and skills to a given situation. Such exercises are generally situational, task oriented, and problematic in nature. In transfer exercises, students demonstrate their competence by using and adapting their knowledge and skills in situations which may include arrangement,

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measurement, assessment, analysis, construction, and decoration. Simulated as well as real life assignments can be used in designing such exercises. Students, when given transfer assignments, typically need to evaluate the situation, determine the needed content and skills, decide on an approach, and implement what has been learned.

One purpose of transfer exercises is to provide students with practice in calling upon and using all or part of what they have learned. This type of exercise may demand either specific replication or adaptation of skills. If a correct and incorrect transfer response can be determined for a situation, specific replication is more likely to be necessary. When a situation is new and unique, an adaptation and alteration of skills are generally invoked in providing an appropriate response. In such situations, an appropriate use of knowledge and skills is determined in part by the degree to which satisfaction and need are fulfilled.

A similar and related purpose for transfer exercises is to encourage student analysis; that is, the assessment, sequencing, and implementation of needed skills for the solution of a given problem. For most new and creative situations, skills are also needed with the what, how, and when based on analysis. An artist having skills in mixing colors, drawing figures, and using brushes, must still analyze what is needed when painting a picture. Similarly, the student considering the importance of an historical event, needs to apply historical principles in developing a proper interpretation.

The focus on usage is a fourth and final consideration of transfer exercises. Of all the exercises this particular type requires that students actually demonstrate their mastery of the knowledge and skills as applied to practical and real life issues, problems, and situations. Performance, in this sense, involves the carrying through to completion of specific learnings. For example, given the responsibility for the decoration of a living room, a total and complete design would be

recommended by each student. Although knowledge and skill adaptation is frequently needed for such exercises, the results can be readily observed, measured, and evaluated.

Transfer exercises can take a variety of forms and can be used in most content areas. Instances where transfer exercises may be appropriately used include structure framing of a house, interpreting and organizing information, tuning a car engine, drafting a plan for installing a heating system, evaluating art work, assessing a city's public transportation needs, and analyzing a school's curriculum. In each instance the accomplishment of the task, the use of knowledge and skills, the level of performance, and the degree of adaptation can be determined and measured by the teacher.

CONCLUSION

Four types and levels of drill exercises may be designed and used by teachers to enable students to acquire, refine, and reinforce learned skills. The four levels include: (1) model exercises which require students to copy what has been presented to them; (2) recognition exercises which necessitate students to distinguish and perform the correct as opposed to the incorrect skills; (3) construction exercises which have students perform specific skills with minimum assistance; and (4) transfer exercises which require students to apply and adapt their skills to new and different situations. In all four levels the frequency, sequence, and extent of use will depend upon the importance of mastering skills and the types of drills to be taught. Drill exercises may be used to increase competence and performance as well as to evaluate the degree of competence displayed in performing the learned skills.

Drill exercises are not appropriate for the acquisition of all course content. The purpose for and use of drill are instructional decisions which teachers

need to make considering their objectives, the nature of their course content, and the level of student achievement desired. Drill is an instructional technique which, like all instructional techniques, is an effective means for learning.

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